

Server and Switch Integration

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San Jose January 23-24, 2001



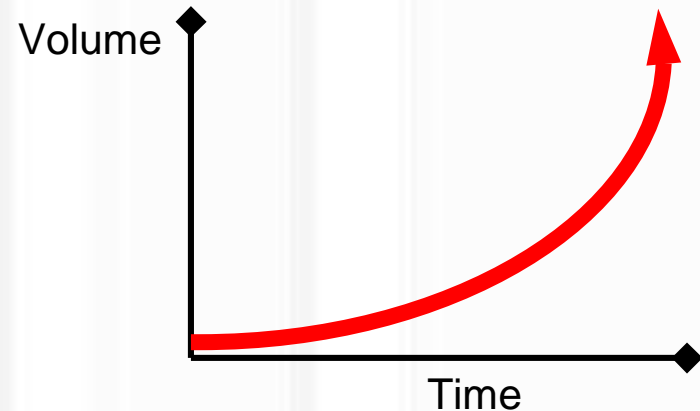
Taipei February 14-15, 2001

Topics

- What's the trends network bandwidth
- Why is there a growing need for SLB's
- What's the trend in SLB and Switches
- What's trend in Server and Switch integration

The Internet Data Expansion

- More Users*
 - 1998: 142M
 - 2001 (today) : 394M
- More Hosts*
 - 1999 : 68M
 - 2000 : 99M
 - 2001 : 109M
- More Data (per user)
 - Data Volume seems to be monotonically non-decreasing



Δ = Data
 T = Transactions
 β = Bytes
 n = Internet Users
 V = Data Volume

$$V = f(\Delta, T, \beta) \times f(n)$$

*Source: www.netsizer.com

Network Bandwidth Cycle

**Increasing
BW
Demands**
•More users
•Richer data
•More Volume

**Increased Access
Bandwidth**

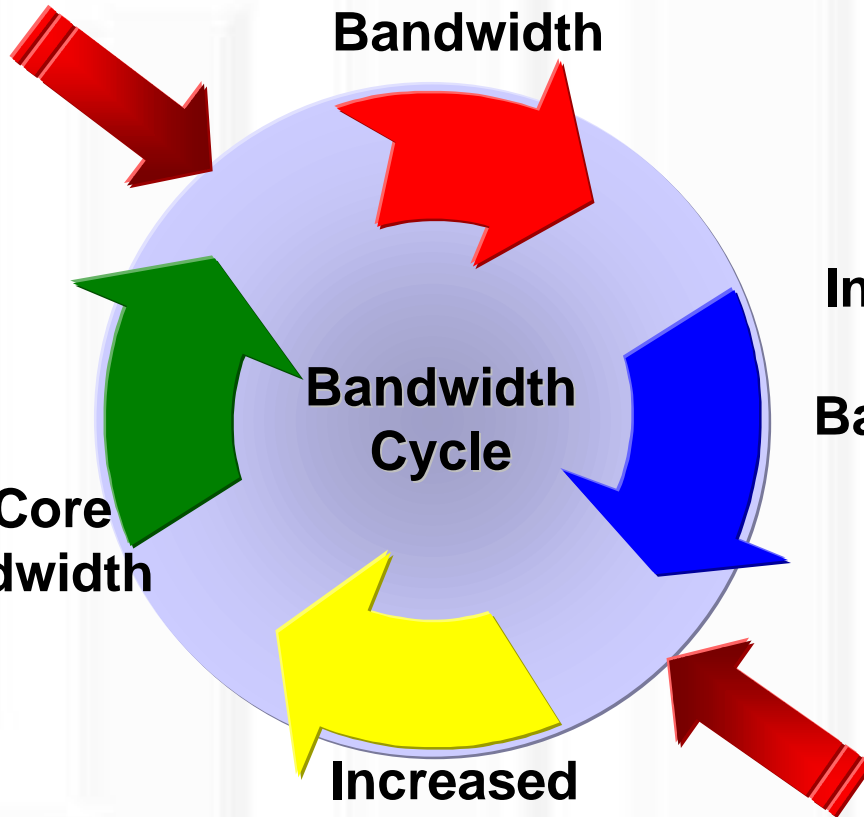
**Increased
Metro
Bandwidth**

**Increase In Core
Network Bandwidth**

**Increased
Router and Server
Performance**

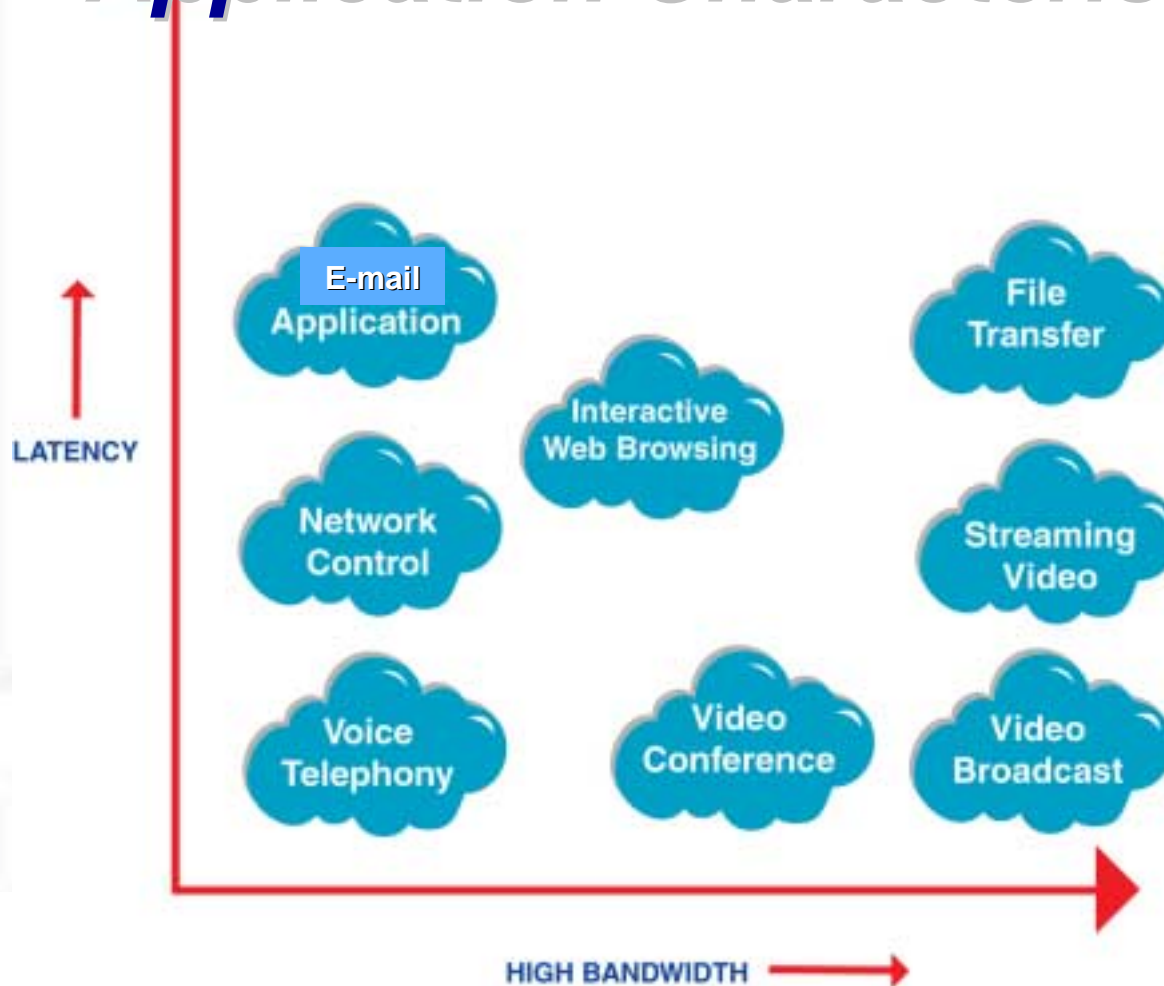
New Applications

- SuperPortals
- SANs
- Napster
- HDTV



Increasing User Demands

Application Characteristics



Increasing Access Bandwidth

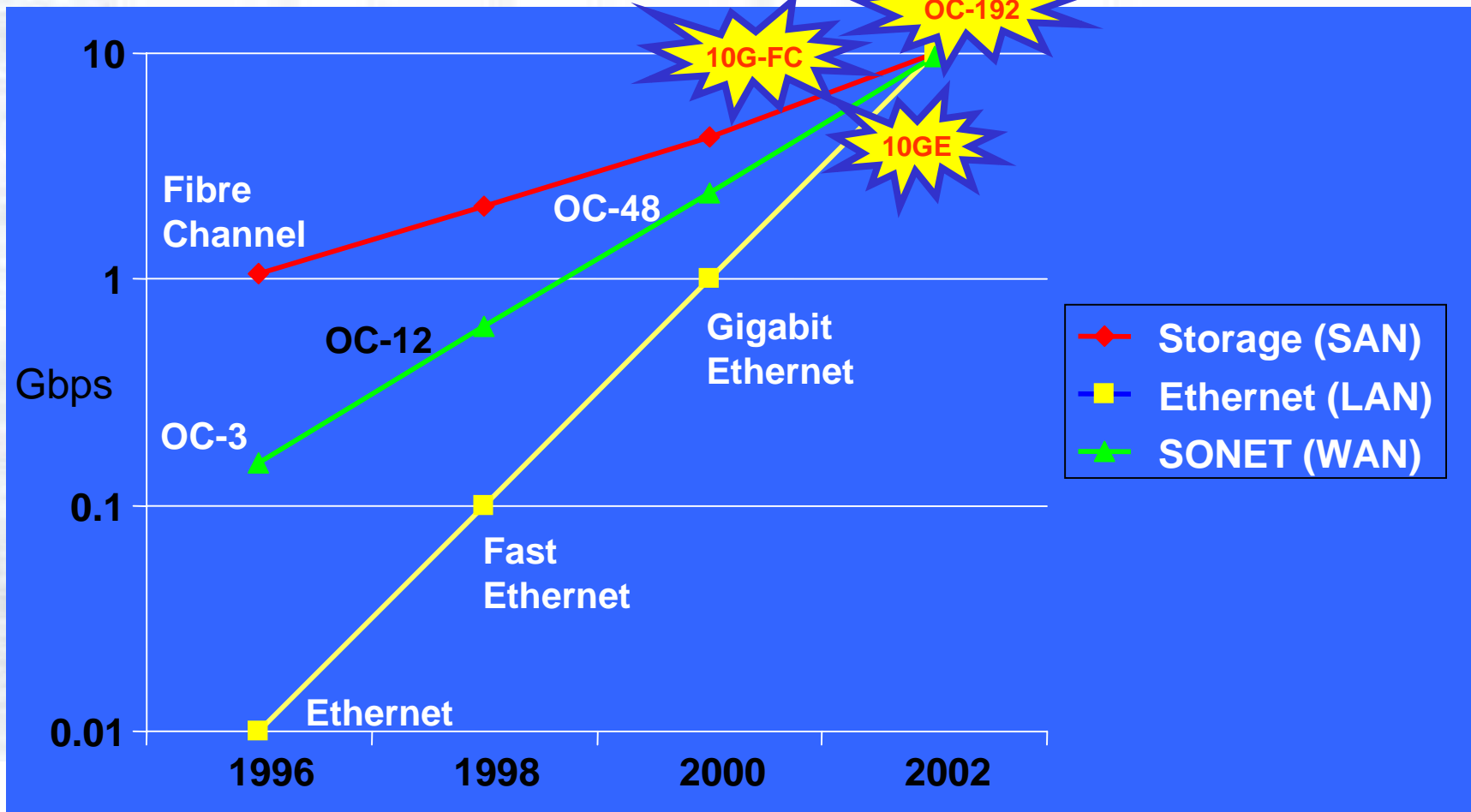
- Rapid deployment of High Speed access over xDSL, Cable and Fiber
 - And only 2% of US homes have HS access today but over 50% has performance PC's
 - xLEC (finally) getting biz processes in place to deploy high speed services
 - Dramatically lower cost of high speed access
- Trends fueling the growth
 - Faster HS technologies like EFM, VSDL and PON
 - Faster Better Cheaper - Internet enabled PC's

Increasing Metro Bandwidth

- The Metro Network
 - Upgrade of SONET equipment from 155Mbps to 2.4Gbps and soon 10Gbps
 - Deployment xWDM (more light waves per fiber)
 - Faster provisioning with Next Gen equipment
 - The emergence of Fast Ethernet and Gigabit Ethernet to businesses
- Service Providers
 - ILEC, CLEC, BLEC
 - New Data-only-SP with fast cheap bandwidth

Increased Core Bandwidth

Trends



Destroying The Bottleneck

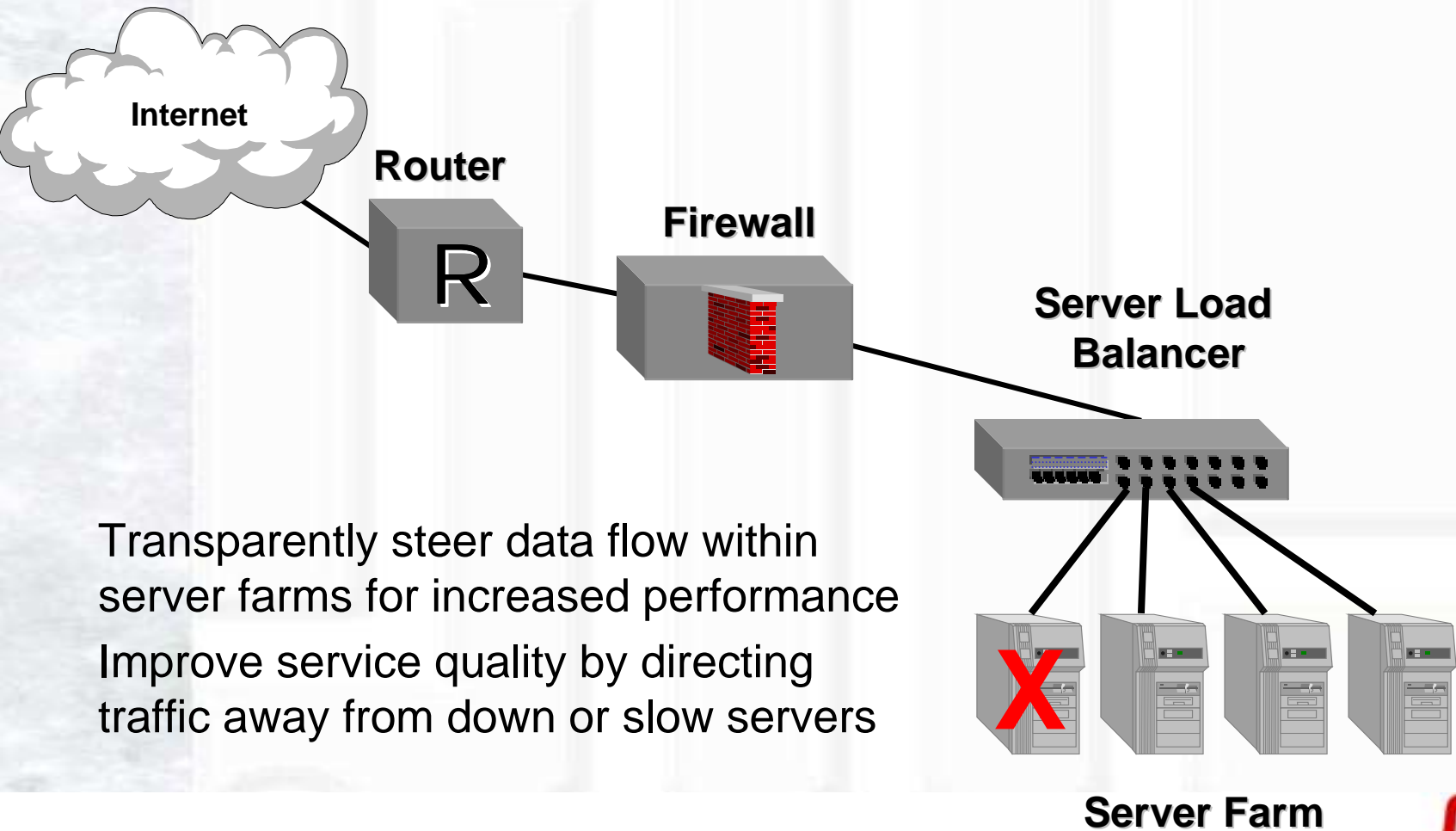
- +250 Startups targeting the Metro and Core Bottleneck
 - Optical, Cable and DSL technology constantly being enhanced
 - Ethernet now running from 10,100,1000 to 10Gbps
 - Multi Layer LAN Switches leading the performance envelope
- The Server remains a performance bottleneck

Server Performance *Bottlenecks*

- OS overhead and inefficiencies
- Applications overhead
 - Large Databases
 - Complex active page generation
- TCP/IP protocol processing
 - Checksum generation
 - SSL encryption and key computation
 - Data copy between layers

SLB Technology resolves the bottleneck

Generic SLB Function



SLB: Packet Flow

Packet Parsing and Filtering

Ingress

Address Resolution

- L2-L7 lookup
- Filtering
- Packet Parsing

Server Selection

Server Load Balancing Algorithm

- Weighted RR
- Least no. of connections
- URL Based
- Server Utilization
- Persistent policies
- Server Health

Modification

Frame modifications

- IP Address Substitution
- IP Header Checksum
- NAT
- SSL Acceleration
- DES Key Computation

Scheduling

Egress

Priority Queuing

- WRR
- RED
- WRED
- Traffic shaping

 = hardware functions

 = software functions

The Evolution of SLB

- 1st Generation

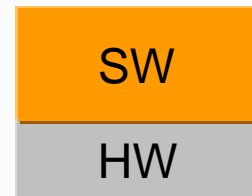
- Software solutions on a standard OS running on a 'standard' PC/Server platform (100Mbps)

Relative Complexity



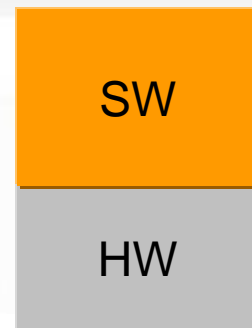
- 2nd Generation

- Specialized hardware (ASIC) and dedicated Software and OS (1000Mbps)











- 3th Generation

- Dedicated Software and OS
- Wire speed hardware based on Scalable Switching and Network Processor technology (10Gbps)









SLB Technology & Benefits

Core value add

-  Balanced workload
-  Performance scalability
-  Platform independence
-  Faster response time
-  Redundancy - Uptime
-  Max Utilization of server resources
-  Offloading servers (SSL)
-  Operational simplicity

Enhanced functions

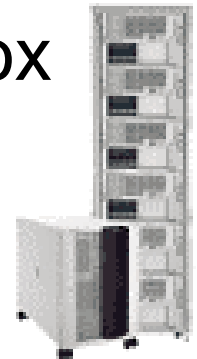
-  User profiling
-  SLA / Class of services
 -  Bandwidth
 -  Response time
 -  Security
-  Policy based SLB

Enhanced SLB Functions

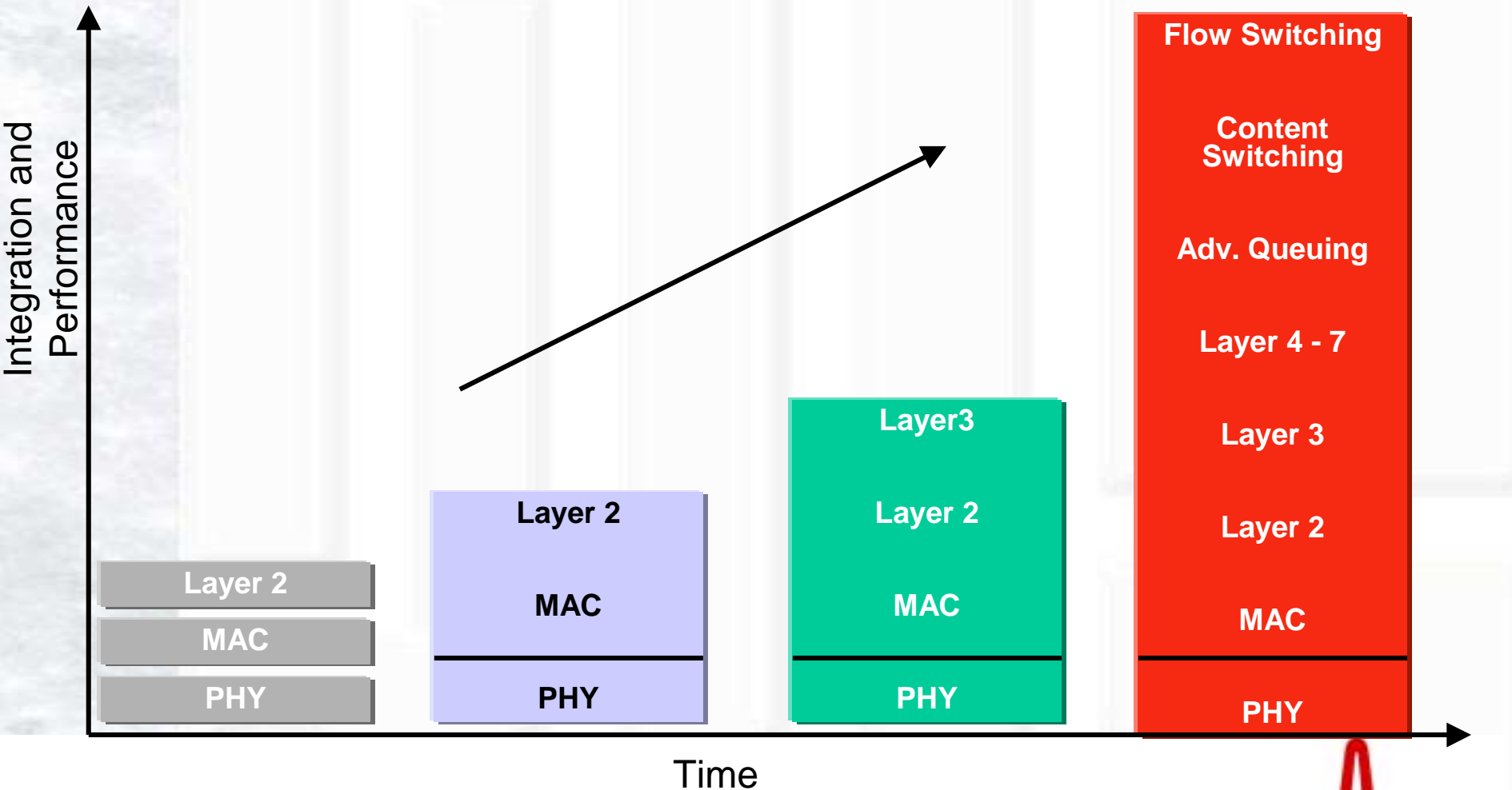
- Connectivity monitoring
- Active content verification and monitoring
- Application Verification
- Response Time Analysis
- Alarm Generation and Event Logging
- Content replication
- Web caching
- Global Redirection

Server Trends

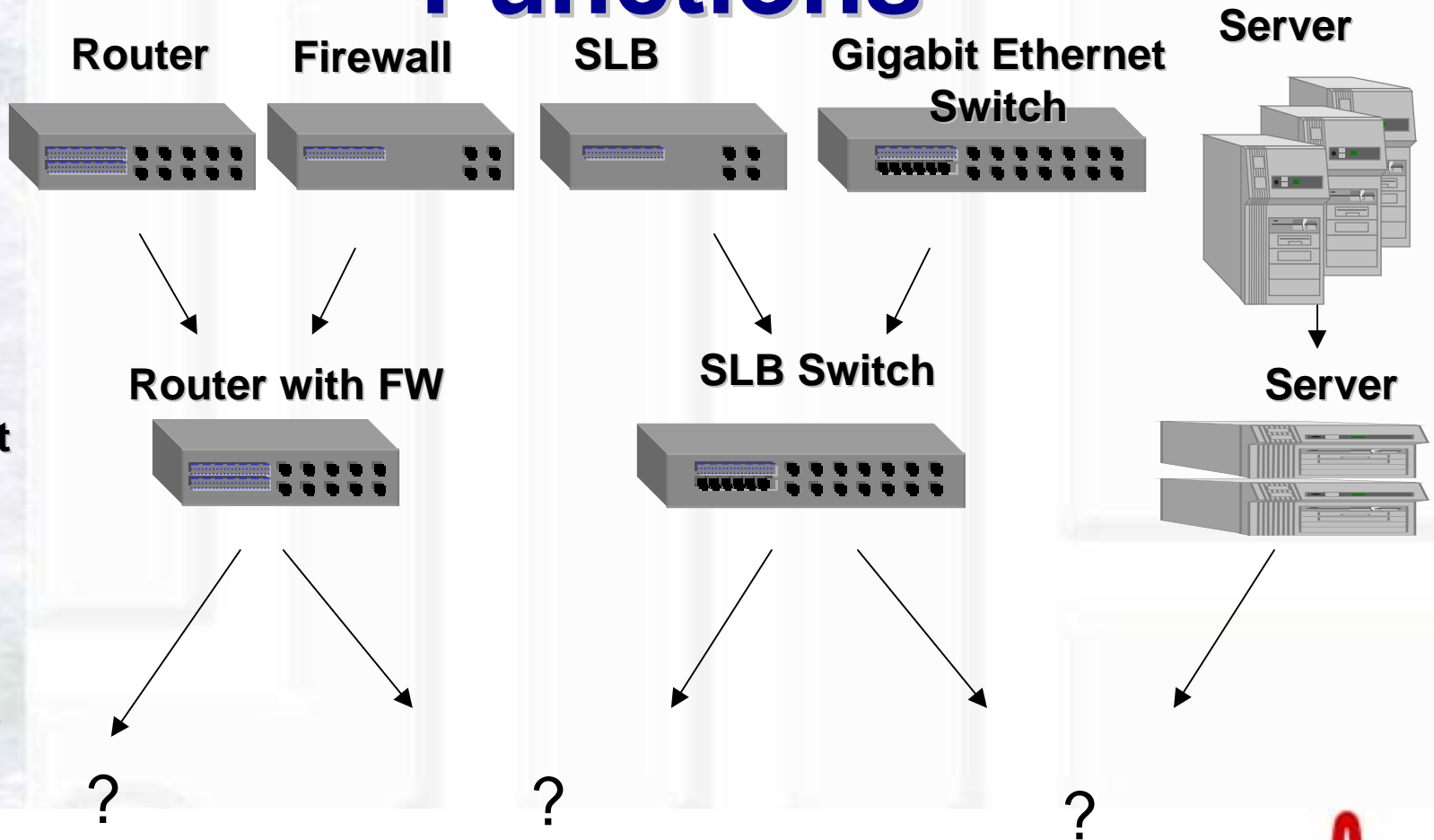
- More Servers
 - Increased use of Server Farms
- Higher Density
 - Smaller boxes and more servers per box
- Scalable Performance
 - SMP and RAID
- Faster I/Os
 - GE, 10GE, FC and in the future IB



Switch Integration Trends



Evolution of Network Functions



Current

Future

SLB Integration Benefits

- Reduced cable complexity
- Improved performance of SLB
 - Optimized information to SLB algorithms
- 100% Virtual Uptime
 - Fast fail over (ms), Shielding Down Time
- Reduced shelf space requirement
- Lower Cost of Ownership

Integration Issues

- Very high software content increases complexity
- Reliability and serviceability
- Potential single point of failure
- Harder to schedule downtime
- Requires a software support model

SLB Pitfalls

- SLB is much more than switching
 - Management is key part of the solution
 - Very software heavy
 - Millions lines of C code
- And the feature set is changing daily
 - Frequent software upgrade

Summary

- Data volume explosion
- Massive increase in bandwidth
- Servers being the bottleneck
- SLB is key to alleviate server bottlenecks
- Ongoing evolution of SLB functions
- Next Gen: Switch and server integration

Thank you



San Jose January 23-24, 2001



Taipei February 14-15, 2001

Sever and SLB model

- Two tire model
 - Distributed SLB functions
 - Server integrated “thin” SLB switch
 - Cable management
 - Inside Server traffic load balancing and traffic steering
 - External BIG SLB switch
 - Fat pipes to multi-server-chassis
 - Intelligent load distribution algorithms